

The City of Tucson HCP: Burrowing Owl Occupancy Surveys within the City of Tucson's Avra Valley Properties

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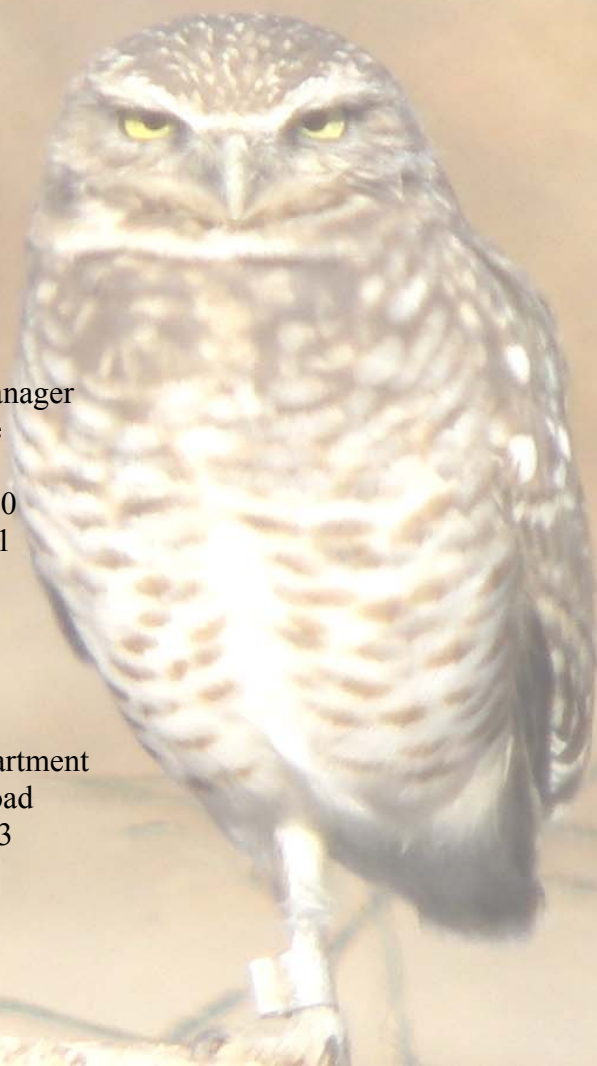


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October 2006



RECOMMENDED CITATION

Grandmaison, D.D., and L. Urreiztieta. 2006. The City of Tucson HCP: Burrowing owl occupancy surveys within the City of Tucson's Avra Valley properties. Arizona Game and Fish Department, Research Branch, Phoenix, AZ.

ACKNOWLEDGMENTS

Michael Ingraldi supported the project through contract administration. Shawn Lowery and Michael Ingraldi provided assistance with manuscript revision. Many thanks to our field crew: Shawn Lowery, Scott Blackman, Dennis Abbate, Angie Stingelin, Ryan Couch, Ron Mixan, Louise Mitzal, and Sarah Newell. Renee Wilcox provided administrative support.

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PROJECT FUNDING

Funding for this project was provided under a cooperative agreement with the City of Tucson, contract #061050.

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David D. Grandmaison and Lirain Urreiztieta

Introduction

The western burrowing owl (*Athene cunicularia hypugaea*) was once a common breeding bird throughout North America. However, burrowing owl populations have been declining throughout their range as a result of habitat loss, predation, disease, and rodent control programs (Haug et al. 1993, James and Espie 1997, Desmond et al. 2000). The burrowing owl is now federally Endangered in Canada (Wellicome and Haug 1995), considered a species of national conservation concern in the United States (U.S. Fish and Wildlife Service 2002), and one of the priority species in the Sonoran Desert Conservation Plan (Sonoran Desert Conservation Plan 2002). In Mexico, burrowing owls are listed as federally threatened. The burrowing owl is protected in Arizona under Arizona Revised Statute Article 17 and under the Migratory Bird Treaty Act in the United States and Mexico. This designation protects the owl from actions resulting in death and the destruction of active nest burrows. In Arizona, the burrowing owl is thought to be predominantly non-migratory (Arizona Game and Fish Department 2001). Research in the Tucson Basin suggests that approximately 50% of the breeding burrowing owl population consists of annual residents and that males are more likely to over-winter than females (Conway and Ogonowski 2005).

Burrowing owl breeding habitat consists of dry, open areas, characterized by short vegetation, the absence of trees, and the presence of suitable burrows (Haug et al. 1993, Klute et al. 2003). Breeding habitats include prairie dog (*Cynomys ludovicianus*) colonies, fallow agricultural fields, road rights-of-way, and urban areas such as airports and golf courses (Klute et al. 2003). In the Tucson Basin, burrowing owls can be found in high density on the Davis-Monthan Air Force Base, along the banks of the Santa Cruz River, and in agricultural fields in the Avra Valley. Because burrowing owls do not dig their own burrows, they are largely dependent on fossorial mammals for burrow excavation, nesting in abandoned burrows created by small and medium sized mammals such as black-tailed prairie dogs, round-tailed ground squirrels (*Citellus tereticaudus*), badgers (*Taxidea taxus*), and coyotes (*Canis latrans*). With the reduction and elimination of fossorial mammals, burrow availability can be a potentially limiting factor for population persistence (Desmond and Savidge 1996, Desmond et al. 2000). For example, in Arizona black-tailed prairie dogs were once abundant but were extirpated in the late 1930's (Arizona Game and Fish Department 2004).

As part of the proposed City of Tucson Habitat Conservation Plan (HCP), the western burrowing owl was identified as a species of concern due to its high risk of take during planned development activities in the Avra Valley planning sub-area. An estimated footprint of

approximately 7,500 acres in Avra Valley may be needed to expand public water infrastructure (e.g., recharge basins, evaporation ponds, treatment plants, etc.) and these developments have the potential to disturb existing burrowing owl habitat depending on their location and configuration. The purpose of this project was to provide information regarding the presence and distribution of burrowing owls within the Avra Valley planning sub-area. This information will allow city managers to incorporate burrowing owl conservation into the future development of public water infrastructure projects in Avra Valley, thereby reducing impacts to burrowing owls and their habitat. In addition, understanding burrowing owl habitat use in Avra Valley and implementing conservation measures may help facilitate the persistence of the local burrowing owl population in the Tucson planning area.

Study Area

The study area is located in Avra Valley, 10 miles west of Tucson, Arizona (Figure 1). This valley represents a tributary of the Santa Cruz watershed encompassing three major washes, the Brawley, Los Robles, and Blanco drainages, which generally flow from south to north across the valley. Avra Valley, which is dominated by the Arizona Upland/Sonoran Desertscrub vegetation community (Brown 1982), is bounded by the Silverbell, Waterman, and Roskrige Mountains to the west, Saguaro National Monument and the Tucson Mountains to the east, and the Tohono O'Odham Indian Nation and Altar valley to the southwest. The proposed HCP area encompasses approximately 21,600 acres within the Avra Valley planning sub-area. Much of this property historically supported agriculture but is now managed for future city water development projects by Tucson Water. The only intensive on-site management is for invasive weed control, fire abatement, and recharge basins. Sonoran Desertscrub is the dominant vegetation community within the planning sub-area, and is characterized by creosote bush (*Larrea tridentata*) and triangle-leaf bursage (*Ambrosia deltoidea*). Much of the Avra Valley planning sub-area is comprised of Sonoran Vacant or Fallow Land where velvet mesquite (*Prosopis velutina*), burroweed (*Isocoma tenuisecta*), desert broom (*Baccharis sarothroides*), desert globe mallow (*Sphaeralcea ambigua*), prickly Russian thistle (*Salsola tragus*), silverleaf nightshade (*Solanum elaeagnifolium*), western tansymustard (*Descurainia pinnata*), shaggyfruit pepperweed (*Lepidium lasiocarpum*) and several species of grasses have become established (Liberti and Wyneken 2006).

Methods

Survey Delineation and Habitat Evaluation.

We conducted our initial evaluation of 35 City of Tucson-owned Avra Valley properties with Tucson water personnel in November 2005. We qualitatively evaluated burrowing owl nesting habitat potential by characterizing each property according to vegetation density, presence of concrete irrigation canals, and availability of usable burrows. This allowed us to direct breeding season surveys towards parcels with high burrowing owl nesting habitat potential.

Vegetation structure suitable for nesting burrowing owls was defined as patches of treeless areas comprised of bare ground and/or short vegetation (10 – 50 cm in height) ≥ 1 hectare in size (Uhlmann et al. 2001). It should be noted that the specific patch size requirements for Sonoran burrowing owl populations has not been established. We also included low density creosote bush

(*Larrea tridentata*) vegetation communities in this definition because burrowing owls have been observed in creosote flats at various times during the year (BISON 2006, Arizona Game and Fish Department, unpublished data). Current research evidence suggests that erosion along cement irrigation canals creates soil subsidence chambers that have the potential for burrow formation (M. Ingraldi, Arizona Game and Fish Department, personal communication 2005), and special care was taken to address these areas during our survey efforts. Therefore, we identified the presence of an irrigation canal as increasing the nesting potential for burrowing owls. Fossorial mammals (e.g., ground squirrels, badgers, coyotes) inhabit Avra Valley, and have the potential to create burrows usable by burrowing owls. Given the critical requirement of burrows for burrowing owls, we identified properties with burrows or sign of fossorial mammals observed during our initial site evaluation as having a high likelihood of burrowing owl presence.

Winter Non-Breeding Survey

All areas that met the vegetation structure characteristics of potential nesting habitat were surveyed during January and February 2006 (Appendix A). Within each parcel, a series of transects spaced 50 meters apart were established in a north-south orientation. Surveyors recorded the location of all burrows within 25 meters of each transect. Burrows were categorized by their potential to support burrowing owls. Specifically, we assessed the size of the burrow entrance (height 8 – 20 cm; width 8 – 28 cm), burrow depth (> 1 meter), and evidence of past use (e.g., fresh pellets, prey remains, owl feathers, and ornamentation). Category 1 burrows exhibited no evidence of use by burrowing owls. Category 2 burrows showed evidence of previous use, but use was not recent (e.g., old whitewash, old pellets, cobwebs, or debris at burrow entrances). Category 3 burrows showed sign of recent use (e.g., fresh whitewash, fresh pellets, feathers, or nest ornamentation). During our winter surveys, presence of owls was documented by recording the number of owls at each burrow. The location of all suitable burrows was recorded and mapped. When we detected evidence of use (i.e., category 2 and 3 burrows), we cleaned and removed any owl sign (i.e., pellets and white wash). This allowed us to identify occupied burrows if fresh sign was present during our breeding season survey effort.

Summer Breeding Survey

In early June 2006, during the peak of the burrowing owls breeding season, we revisited all burrows that had supported evidence of burrowing owl use and/or where owls had been detected during the winter survey (i.e., category 2 and 3 burrows). Burrows were observed from a distance of >250 meters using binoculars and spotting scopes to determine the presence of owls prior to approaching the burrows. Visual surveys were designed to detect owl occupancy at the focal burrow as well as neighboring burrows, effectively increasing the number of burrows revisited during summer surveys. If no owls were observed during this initial five minute observation period, we approached burrows to assess evidence of owl occupancy based on owl sign. Burrows with sign (e.g., whitewash, pellets, feathers, ornamentation) could now be identified as having been used sometime during the interval between our winter and summer survey.

Results

Burrowing owls were present on nine properties (Appendix A) and suitable burrows were detected on 16 properties (Appendix B). Our winter survey detected a total of 1,836 burrows

suitable for burrowing owl use based on opening dimensions and burrow depth. Seventy-one burrows exhibited sign of recent use by burrowing owls (e.g., fresh pellets, prey remains, owl feathers, and ornamentation), and 214 had evidence of past use (e.g., old pellets, whitewash) and were classified as category 3 and 2 burrows, respectively. The remaining 1,551 burrows had potential to be modified for use by burrowing owls but had no sign indicating recent or past occupancy. A total of 34 burrowing owls were detected during the winter survey.

We revisited a total of 292 burrows during the breeding season (6 June to 20 June; see Appendix B) that showed evidence of recent or past use (i.e., category 2 and 3 burrows) or where owls were detected during winter surveys. Of these, 117 had collapsed since the previous visit and were unsuitable for burrowing owl use. Four adult owls were detected when revisiting burrows that had supported evidence of burrowing owl use and/or where owls had been detected during the winter survey (Appendix A). One burrowing owl was detected at each of the following parcels: Santa Cruz, Simpson South, Cactus Avra, and Bowden farms (see maps in Appendix B). Three of these owls were associated with specific burrows, while the fourth was not observed near a suitable burrow. We were unable to verify active nesting as no juvenile burrowing owls were observed during breeding season surveys. However, each of the three burrows associated with owl detections displayed some sign of occupancy (whitewash, fresh pellets, and feathers). The burrow on the Santa Cruz Farm also had ornamentation (e.g., pieces of plastic or other garbage) outside the entrance. Two burrows that were revisited at Chu and Martin farms had fresh pellets, although no owls were detected at these locations.

Discussion

The City of Tucson's Avra Valley properties have high burrowing owl wintering and breeding habitat potential given the abundance of burrows and the predominance of short vegetation across many of the parcels. Close proximity to active or historical farmlands may also increase the potential of these parcels as burrowing owl habitat due to increased prey base (Moulton et al. 2006). Burrowing owl surveys conducted in 2003 within the Marana HCP planning area yielded one pair of adults and two juveniles ½ miles east of the City of Tucson's Martin Farm property (T11S R11E Section 19; Alanen 2004). The adult female and one juvenile were banded and radio-collared on 16 July 2003, and were tracked by the Arizona Game and Fish Department's Research Branch. Telemetry data indicated that the female remained near the capture location until mid-September, after which she was not detected again. The juvenile wandered into agricultural fields to the northwest and to the Marana Airpark (Arizona Game and Fish Department's Research Branch, unpublished data). Follow up surveys in 2004 detected seven owls on the property adjacent to the Martin Farm (T11S R11E Section 24; Alanen 2004).

Although Alanen (2004) concluded that burrowing owls were not abundant within the bounds of their survey area, these results might reflect the fact that Avra Valley provides more suitable wintering habitat for burrowing owls. Their surveys were conducted during the nesting season, from June through early September in 2003 and mid-May through mid-July in 2004. Our winter survey results suggest that Avra Valley may be an important wintering habitat, despite lower occupancy during nesting season surveys (Appendix A). Arizona is known to provide winter habitat for burrowing owls that nest in the northern United States and Canada, and loss of this winter habitat has the potential to affect the overall western population of the owl (James and

Ethier 1989, Estabrook and Mannan 1998). Differences in survey methodology may also account for the higher number of owl detections recorded during our surveys. Alanen (2004) used a roadside call-response methodology while we conducted walking transect surveys. It is likely that detection probability for both methodologies varies seasonally (Conway and Simon 2003). However, mapping suitable burrows and identifying owl sign as part of our transect approach, allowed us to identify areas of potential owl occupancy rather than relying on owl response.

Reduced occupancy during the breeding season could be a result of burrow degradation during times of significant precipitation (e.g., spring and winter rains). Many of the parcels surveyed exhibited evidence of sheet flow, which has the potential to degrade burrows. Approximately 40% of burrows that exhibited evidence of burrowing owl use were destroyed between survey periods, well above the 17% rate of burrow destruction documented by Holmes et al. (2003). Although there was no substantial rain event during the interval between winter and summer surveys, this indicates a general lack of structural integrity of burrows in the sandy soils of Avra Valley and a possible threat to burrowing owl habitat quality. However, if burrows are created (by badgers and coyotes) at a rate equal to that of burrow destruction due to sheet flow and erosion, this area has the potential to support burrowing owls during the winter months. Additional research would be necessary to evaluate specific hypotheses regarding burrowing owl occupancy, precipitation, and burrow longevity.

Management Recommendations:

1. The Avra Valley properties are more likely to support breeding burrowing owls if burrows can be reused from one year to the next. Seasonal precipitation patterns may inhibit nesting in low areas where flooding occurs. Therefore, treeless areas of higher ground with low vegetation should be maintained or enhanced to provide burrows that are less likely to be impacted by sheet flow events.
2. Given the friable nature of the soils in Avra Valley, areas of high burrow density should be avoided by heavy machinery that have the potential to collapse burrows. A five-meter radius buffer zone around existing burrows is suggested to reduce the potential for burrow destruction when working in these areas. Any mowing within this buffer should be done by hand. Prescribed burns to maintain low vegetation density may be useful in areas of high burrow density, although timing of these burns should avoid the critical breeding season (April – June).
3. Maintaining populations of burrow builders (e.g., ground squirrels, badgers, coyotes) will help ensure that new burrows are built at a rate adequate to compensate for natural burrow degradation and support burrowing owls during the nesting and non-nesting seasons.
4. Future research and monitoring directions should include the examination of specific factors influencing burrowing owl occupancy and reproductive output (e.g., prey availability, predation rates, toxicological impacts, etc.). Identifying physiographic and vegetation characteristics impacting occupancy and reproduction will further inform

sound management of the City of Tucson's Avra Valley properties in order to conserve burrowing owl habitat while allowing for future water development projects.

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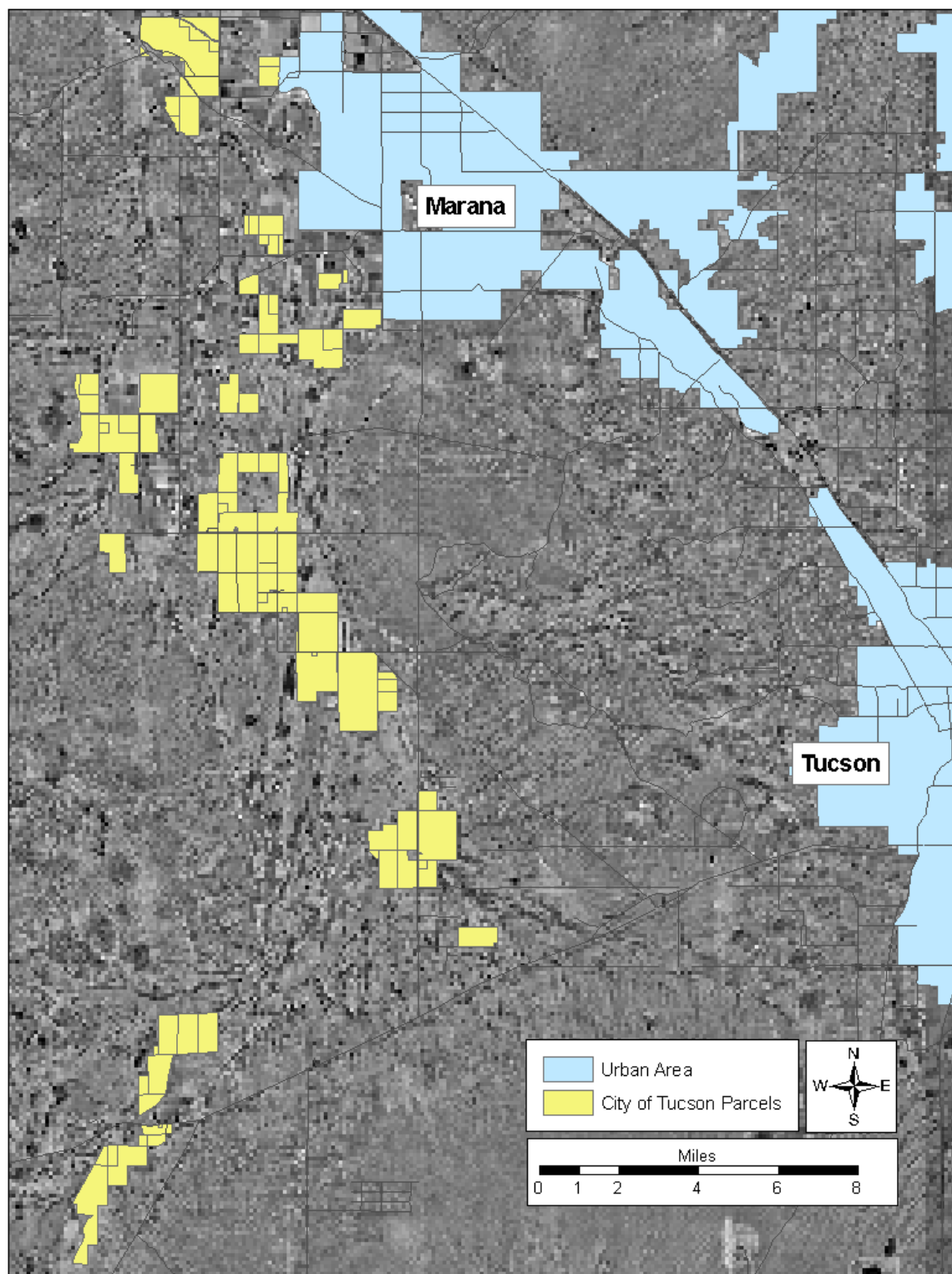
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Figure 1. Thirty-five parcels comprising the City of Tucson's Avra Valley properties, 2006.



Appendix A. Burrowing owl survey results indicating locations of suitable burrows and owl occupancy status for 35 City of Tucson owned properties in Avra Valley, 2006. An “X” indicates where surveys were conducted, whether suitable burrows were present, and parcels where owls were detected. A “P” indicates that fresh burrowing owl pellets were found but no owls were detected.

Parcel Name	Location (Township, Range)	Survey Conducted	Suitable Burrows Present	Winter Owl Occupancy	Breeding Season Occupancy
98 Farm	14S11E	X	X		
Amway Farm	13S10E	X	X	X	
Bowden Farm	13S10E	X	X	X	X
Buckalew Farm	15S10E	X	X		
Cactus Avra Farm	13S10E	X	X	X	X
Cactus Mile Wide Farm	14S11E	X			
Chu Farm	12S11E	X	X		P
Corriskey Farm	12S11E				
Davison Farm	13S10E				
Double Z Farm	14S11E				
Duval / Penzoil Farm	15S10E	X	X		
Edward Amway Farm	13S10E	X			
Flying E Bar Farm	12S10E				
Gin Farm	12S10E	X	X		
Glover Farm	12S11E	X	X		
Growers Finance Farm	14S11E				
Hill Farm	15S11E				
Hurst Farm	11S10E	X	X	X	
Jarvis Farm North	13S10E				
Jarvis Farm South	13S10E	X	X	X	
Kai Farm	12S10E				
Levkowitz Farm	12S11E				
Lupori Farm	12S10E				
Martin Farm	11S10E	X	X	X	P
Morse Farm	14S11E				
Nichols Farm	13S10E				
Reeve's Farm North	12S10E				
Reeve's Farm South	12S10E	X			
Santa Cruz Farm	11S10E	X	X	X	X
Simpson Farm North	11S10E	X	X	X	
Simpson Farm South	11S10E	X	X		X
Trust No. 205	13S10E				
Tucker Farm	13S10E	X	X	X	
Wallis Farm	14S11E				
Weinstein Farm	12S10E				

Appendix B. Maps of burrowing owl and burrow locations in the City
of Tucson's Avra Valley properties, 2006.

